

ThermoSorber

Thermally Driven Heat Pump for Hot Water Heating and Chilling

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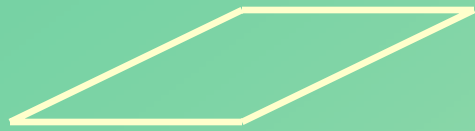
Energy Concepts Co. LLC

Annapolis, MD

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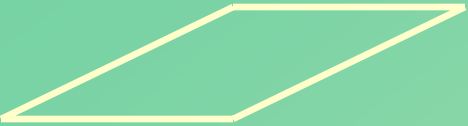
Food Industry Energy Research Program

University of California, Davis



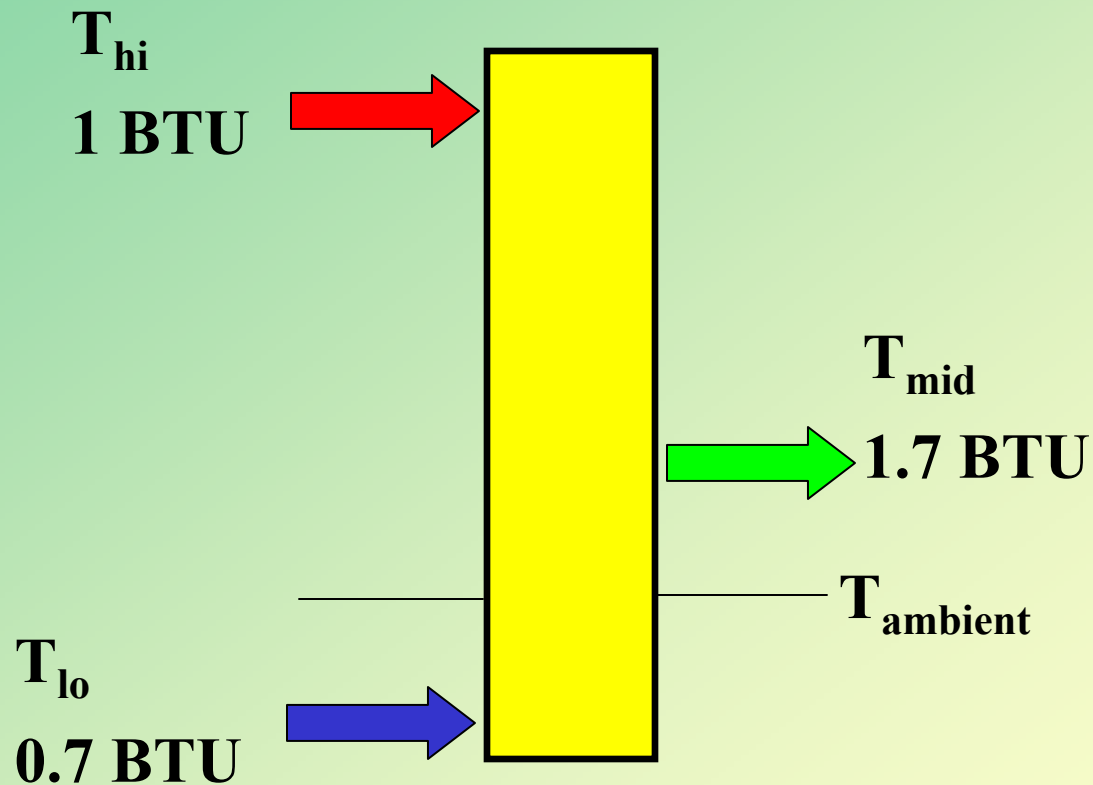
The ThermoSorber:

- Makes hot water and chilling
- Uses same fuel as other hot water heaters
- Requires one-third less fuel
- Chilling duty upgraded to hot water
- Saves both electricity and fuel



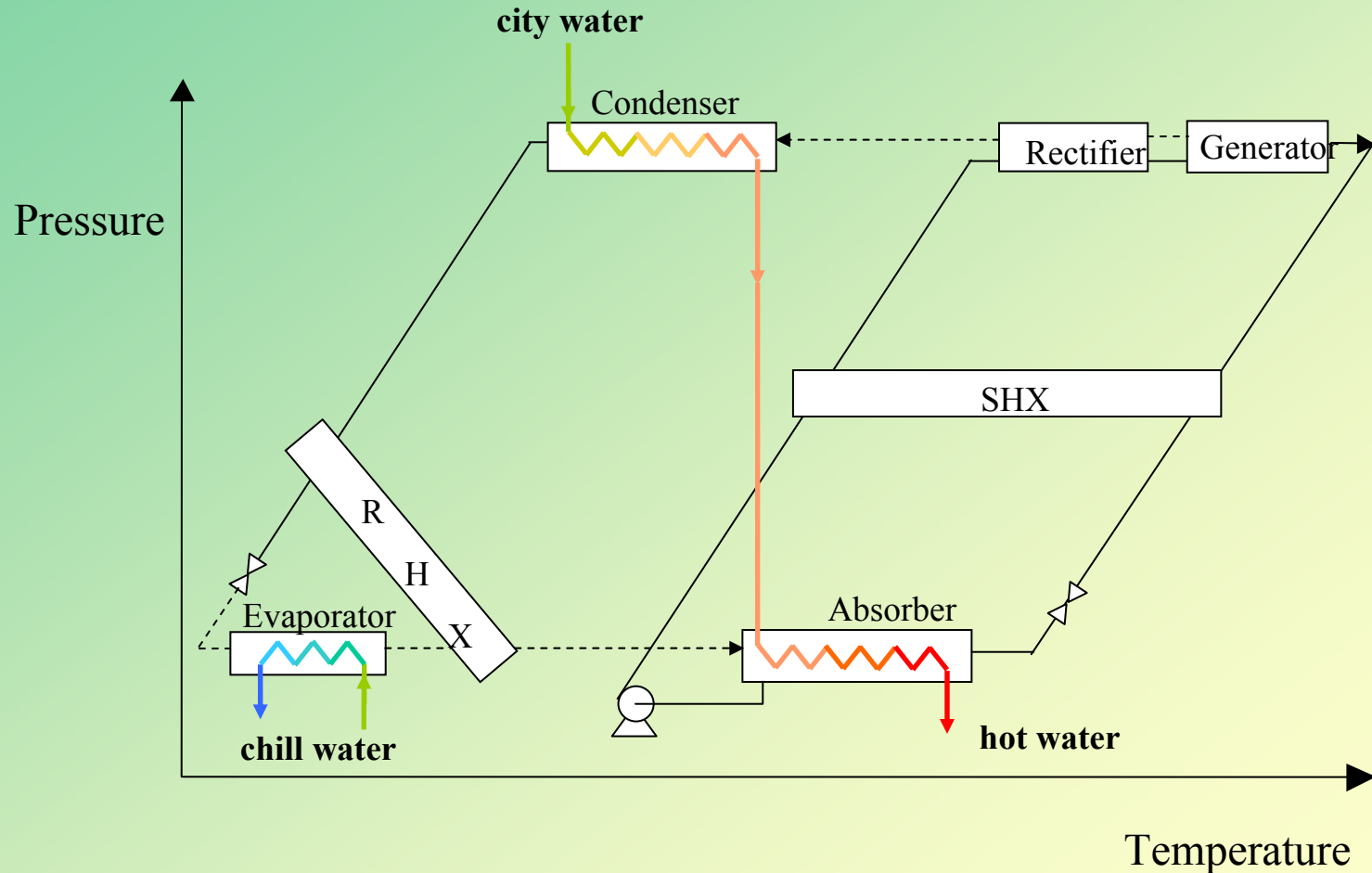
How ThermoSorber Works- Part 1

Trithermal cycle



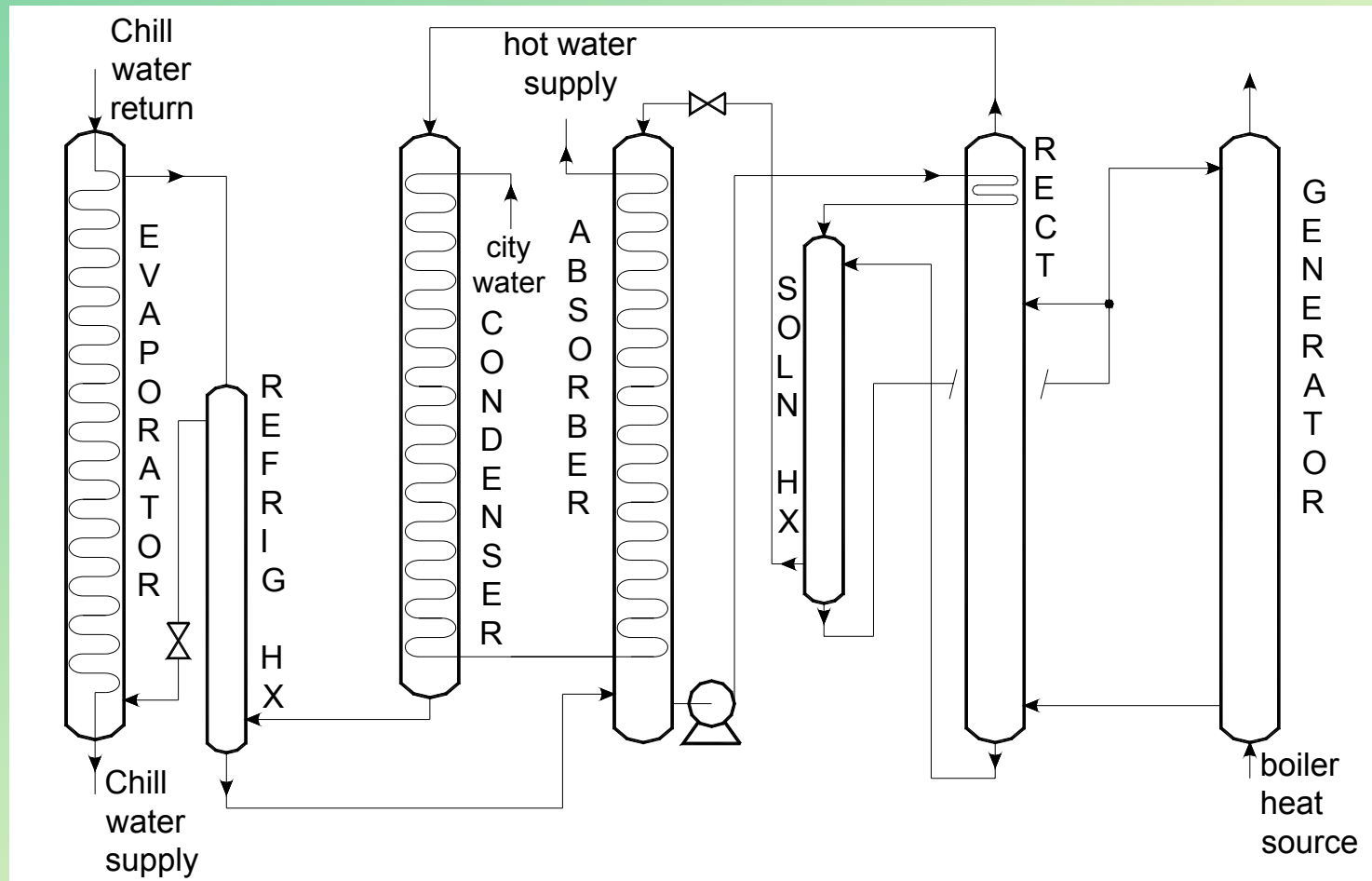
How ThermoSorber Works - Part 2

Thermodynamic Diagram



How ThermoSorber Works - Part 3

Flowsheet



ThermoSorber Packages



60 ton ThermoSorber



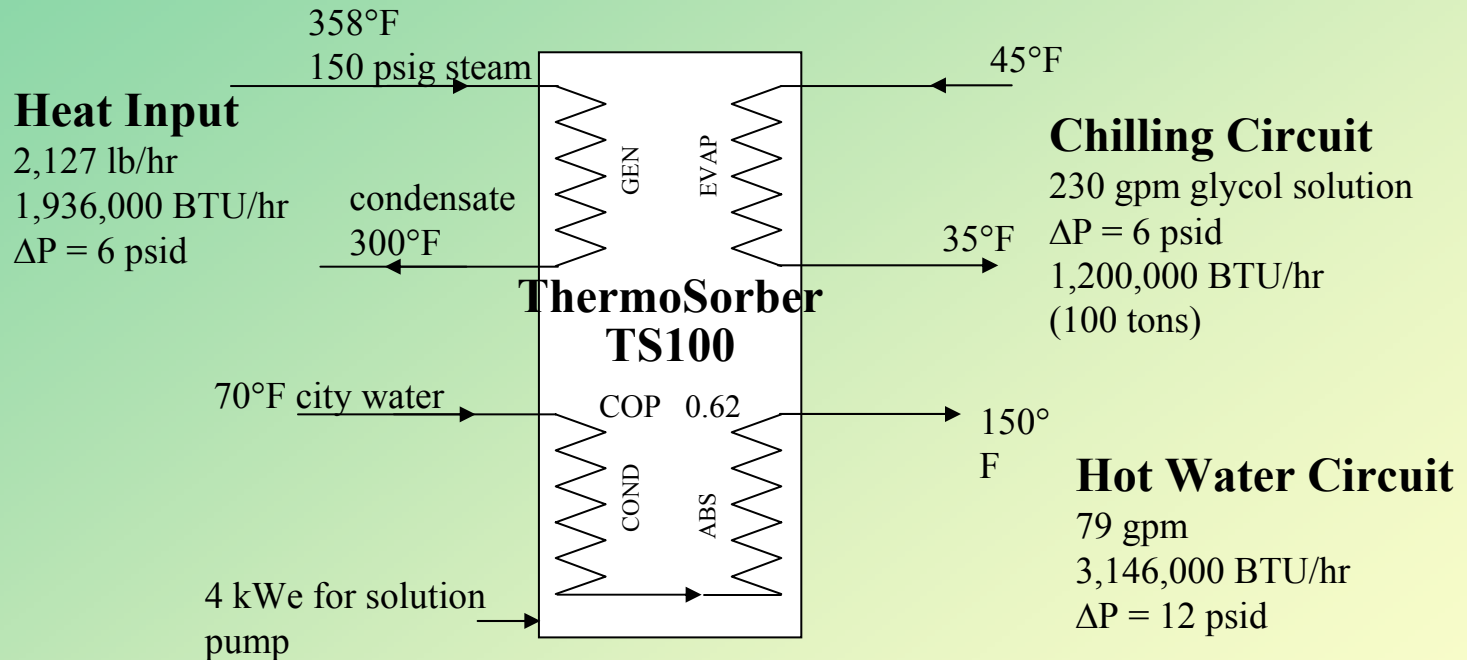
TS25 ThermoSorber



100 ton prototype

How ThermoSorber Works - Part 4

Utilities Perspective



Steam savings = 1,210,000 BTU/hr

Boiler fuel savings (80% efficiency) = 1,512,200 BTU/hr @ \$7

Electric Savings = 95 kW @ 10¢/kWh

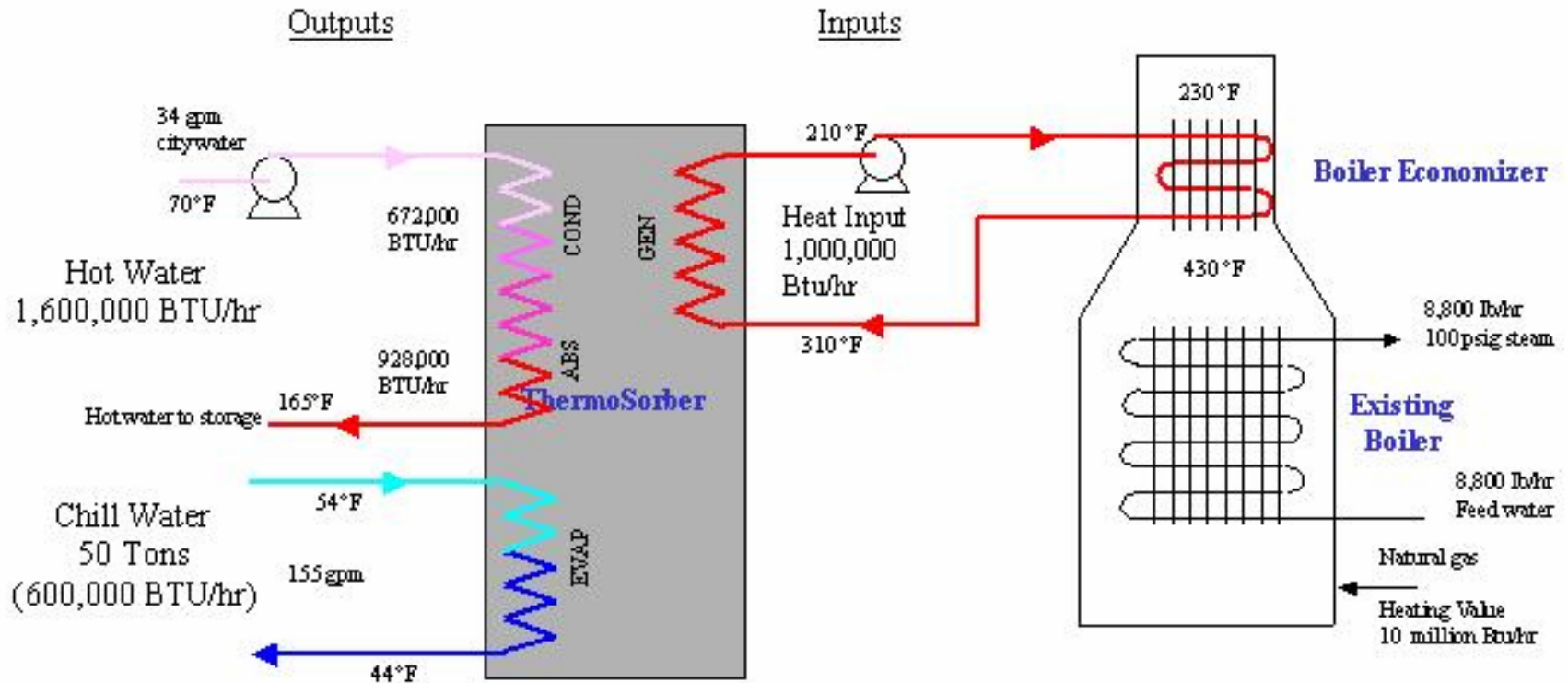
Total savings = \$20.09 / hour



Example ThermoSorber Applications

- ❖ Dairies
- ❖ Breweries & beverages
- ❖ Poultry processors
- ❖ Meat processors
- ❖ Fruit & vegetable dryers
- ❖ Hospitals
- ❖ Hotels
- ❖ Laundries
- ❖ Swimming pools
- ❖ Ice rinks

Boiler Economizer Application



For a 16 hour/day operating schedule, the ThermoSorber provides 25.6 million BTU of water heating (33,000 gallons heated from 70°F to 165°F) plus 800 ton-hours of chilling each day of operation.



ThermoSorber Capabilities

“Saves half the cost of heating hot water”

- Hot Water
 - Capacities from 500,000 BTU/hr to 5 million BTU/hr
 - Temperatures from 130°F to 180°F
- Chilling
 - Standard designs from 25 to 150 tons
 - Custom units of any capacity
 - Temperatures from 20°F to 45°F
- Driving heat (250°F to 350°F)
 - Fuel (natural gas or propane)
 - Steam (15 to 150 psig)
 - Exhaust heat (boilers, engines, incinerators)
 - Process heat



ThermoSorber Advantages

Robust & Reliable

- ✓ No freeze-up
- ✓ No vacuum
- ✓ No corrosion

Compact & Light Weight – 40 lbs per ton

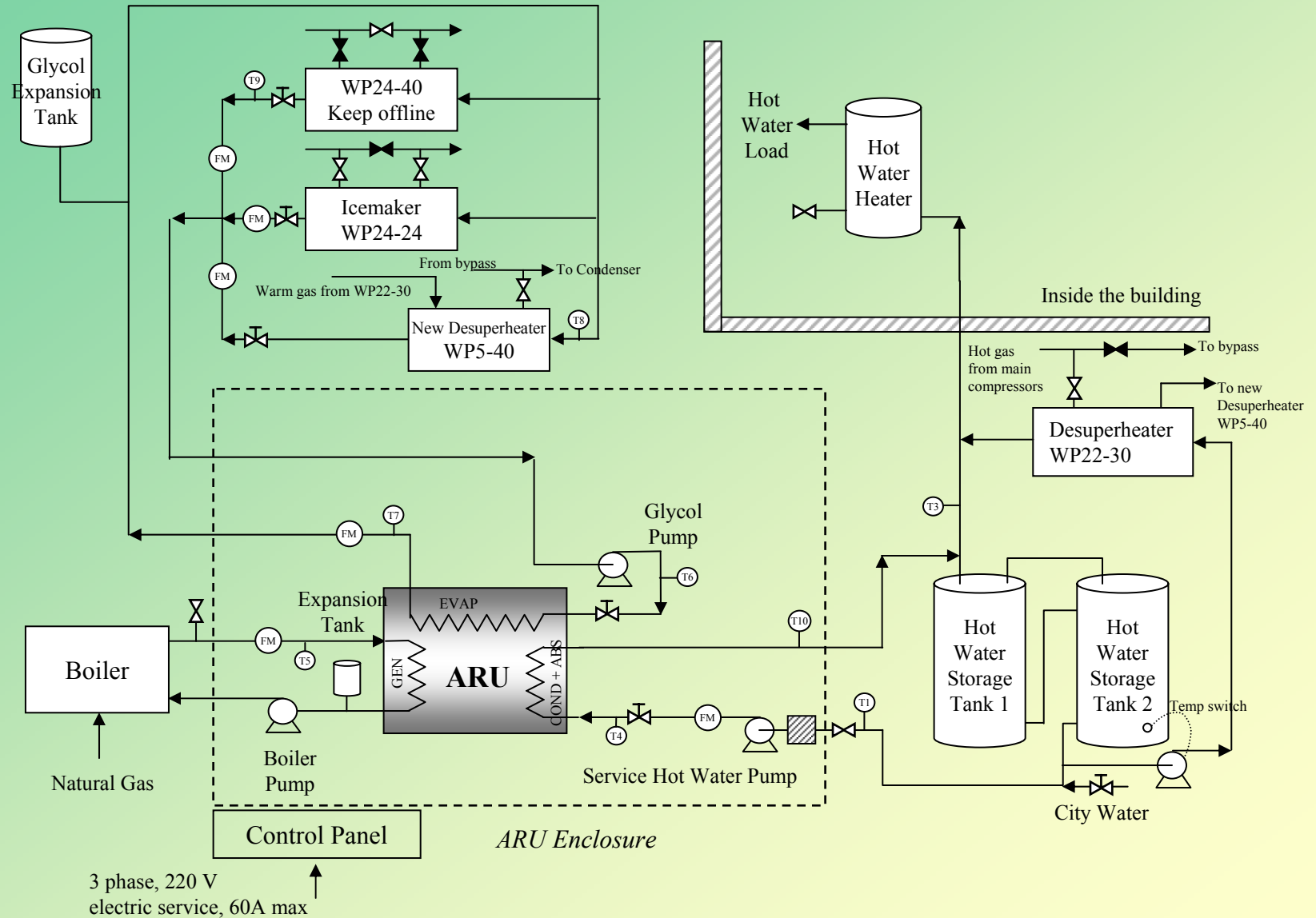
Subfreezing Temperature Range

Minimum NH₃ Charge – 1.5 lbs per ton

Low Maintenance Costs

- ✓ One Moving Part – Solution Pump

Flowsheet – Thermosorber Installation for Poultry Processor



TS 15 Poultry Processor Installation





Competing Technologies

- Other Sorption Units (LiBr, SiGel)
 - No co-production capability
 - X3 footprint and weight
- Electric HWHP
 - No savings in prime fuel
 - No utility cost savings
- Cogeneration (CHP, DG, DER)
 - Barriers to self-generation
 - Higher cost, higher maintenance
 - Exhaust -powered ThermoSorber helps



Companion Products

Same basic platform:

- Single effect ammonia-water absorption cycle
- Standard components
- Standard designs - 25 to 150 tons
- Custom units any capacity

1. ThermoSorber

Co-produces heat pumped hot water and chilling

2. ThermoChiller

Chilling only - lower temperature driving heat (195oF) or deeper refrigeration

3. ThermoCharger

Powered by engine exhaust; chills engine inlet air plus other chilling loads

Other Products



Valero Oil Refinery
Light Ends Recovery Unit

BCHP Ingersoll Rand
70kW Microturbine ThermoCharger





ThermoSorber Benefits

- Saves electricity
- Saves natural gas
- Additional refrigeration capacity with no additional compressor
- Additional hot water heating capacity
- Clean air credits via reduced electric consumption, reduced gas combustion

60 refrigeration ton ThermoSorber

